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Formation and properties of ternary silicide ($\text{Co}_x\text{Ni}_{1-x}$)Si thin films

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Abstract:

A ternary silicide ($\text{Co}_x\text{Ni}_{1-x}$)Si₂ formed by Ni and Co thin films or Ni, Co and Ti thin film deposited on a Si(100) substrate is studied. The results show that a highly conductive silicide ($\text{Co}_x\text{Ni}_{1-x}$)Si₂ can be formed by solid phase reaction of either Ni/Co/Si or Co/N structures. The resistivity of the silicide films is in the range of (15-20) $\mu\Omega\cdot\text{cm}$. The formation temperature of ($\text{Co}_x\text{Ni}_{1-x}$)Si₂ is rather low compared with the disilicides of Co and Ni. XRD data show that ($\text{Co}_x\text{Ni}_{1-x}$)Si₂ has a CaF₂ structure and its lattice constant between that of CoSi₂ and NiSi₂. ($\text{Co}_x\text{Ni}_{1-x}$)Si₂ can also be formed by rapid thermal annealing of a Co/Ni/Ti/Si multilayer structure. A quite low x_{\min} value is shown by RBS/channeling investigation. The joint has a better epitaxy quality as compared with that without a Ti interlayer. It is more uniform and has a good thermal stability and low resistivity. Experiments with two step annealing and chemical selective etching demonstrate that a self-aligned silicided contact and a gate-level interconnection structure can be formed on Si wafers.

Index Terms:

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